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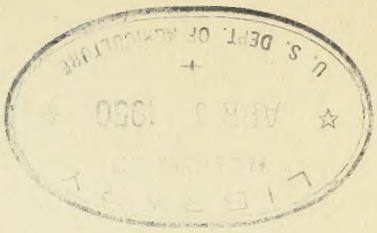

BRANCH OF RESEARCH

MONTHLY REPORT

January, 1935.

FOREWORD

Requests have been received from various Regions and Supervisors for the Monthly Report of Research activities. To meet this demand and to aid in the dissemination of results of current investigations, copies of this report have been duplicated for general distribution to Regional Offices and Forest Supervisors. Much material of interest primarily to Research Administrative officers, has been deleted.

BRANCH OF RESEARCH

January, 1935

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CIVIL SERVICE EXAMINATIONS

Plans are now under way for a series of examinations to meet emergency needs. Formal announcements of these can be expected soon. Included in the present series are the following:

Junior Forester.	Requirements about as in previous examinations. Eligibles wanted by Indian Service, Park Service, Biological Survey, and other agencies.
Junior Range Examiner.	Options in various related subjects to recruit men trained in general animal husbandry as well as those trained in Range Management. Eligibles wanted by Department of Interior (Public Lands), Park Service, Indian Service, etc.
Junior Forest Ecologist	(Includes also physiology and genetics) Requirement - training in botany; eligibles chiefly needed at experiment stations.
Conservationists.	Non-assembled examination. Requirements as before, for various grades from Assistant to Principal (P-1 to P-6). Many eligibles held over from previous register. Regional registers to be established. About 20 different options.
Architects.	Non-assembled. Grades from Assistant to Principal (P-1 to P-6). May be national or regional.
Assistant to Technician.	Regional register. Requirements about as before. Non-assembled examination.
Junior Assistant Technician.	Assembled examination. Regional registers. Requirements - High school graduation and some field experience (Salary 1440).
Engineers	Few special examinations needed. Considerable number of eligibles on civil, mechanical, and hydraulic registers available.

CIVIL SERVICE FOR ALL EMERGENCY EMPLOYEES

An executive order is understood to be before the President placing all emergency employees under Civil Service. It is probable that those employees now employed without standing will be "blanketed in" provided they can qualify under civil service rules and provided they were employed for at least a month prior to the date of the President's signature.

EMERGENCY PROGRAM

The research emergency program has obtained general approval and we are all set to go - "if and when" Congress sees fit! We have become so used to dealing in big figures that millions for Research does not faze us. Among the interesting items may be mentioned the following, though whether we get them all or not depends on the funds available and how they may be spent. The list is far from complete; it touches only some highlights:

Pulp and paper machine at the Laboratory.

Office headquarters buildings at various experiment station headquarters.

Air surveys of large areas in connection with the Forest Survey.

Several complete erosion-streamflow installations for watershed management investigations each encompassing an entire experimental forest and involving installation expenditures of about $100,000.

Large-scale revegetation and reseeding experiments on depleted range lands.

Construction of lysimeters to obtain data on water requirement of natural vegetation, some lysimeters to be 10 x 20, x 30 feet in size, the soil not to be moved. These will be the largest lysimeters ever conceived.

Comprehensive laboratory attack on the basic laws involved in free-burning forest fuels.

Intensive investigation of the climate within the forest and the effect of forest practices upon such climate.

Organization - A Letter From the Forester

F October 1, 1934.
Supervision

Mr. Earle H. Clapp,
Assistant Forester
in charge of Research.

Dear Clapp:

While in Washington last winter some of the regional foresters asked that the forest experiment stations be placed under their supervision. The advisability of doing this was discussed, among other times, at a conference attended by both regional foresters and the experiment station directors who happened to be in Washington.

In reaching a decision I have taken into account such considerations as:

1. The plan of regional office supervision of the forest experiment stations was once tried over a period of several years and failed. On the other hand, the trial of independent supervision has led to an impressive development of research in the Forest Service and the promise of a far greater development. Because of the results of these trials the burden of proof in justifying a transfer was on the regional foresters, but it did not seem to me that they made much of a case.

2. I was greatly impressed in the West last summer with the stimulus which comes from the present set-up. The Research group acquires new information which they want to see put into effect. By the nature of their work they see the work of the Administrative organization on the national forests and elsewhere from a different angle and are critical of it.

On the other hand, Administrative men need the results which Research is responsible for furnishing and are impatient and critical if these results are not forthcoming in a reasonable time. This struck me as a wholesome organization for both Administration and Research. It struck me as much more certain to stimulate progress than one in which the entire field force reports through a single channel and all thought runs through the same mold. Separate organization channels will encourage differences, but differences which force progress are far better than uniformity of thought leading to self-complacency and stagnation.

3. I believe that the most effective supervision, and hence development of research, can be obtained only through independent supervision. The main burden on the regional foresters has been and always will be administrative. Administrative qualifications govern in their selection. With the pressure of administrative work it is practically certain that the supervision of research would be a side issue. Forest research is already a highly specialized activity and is rapidly becoming more so. Thoroughly effective research can be developed only under the direction of the most highly competent men available in the forestry profession, selected because of their qualifications for this class of work and with full time available for its supervision and development.

The research effort of the Forest Service is now so large, it is so much in the public eye on controversial questions of national importance, and the number of critical scientific observers is growing so rapidly that there is a serious question whether we can afford to set up anything less than the highest scientific objectives and shape our organization to reach them.

4. The practically universal plan in all organizations, both public and private in the United States and in other countries, which have both administrative and research activities on a large scale, is the segregation of these activities as a means to efficiency. In many of these organizations, as in the Forest Service, segregation has followed a trial of combined supervision.

5. Undoubtedly it was a recognition of the fundamental principles which underlie such segregation, and a desire to increase the effectiveness of both administrative activities and research, which led in 1915 to the Departmental Order directing the segregation of administration (or its equivalent) and research, in the entire Department. This order, which is still in effect, resulted in the present Forest Service organization.

6. With regional office administration of the forest experiment stations there would always be ground for the suspicion by outsiders in the future as there has been in the past that the desire to sustain administrative policies on controversial questions had influenced results. Independent research has been and would be accepted as impartial.

7. The transfer would undoubtedly be regarded by administration and research men alike as the subordination of research to administration and hence as placing the research activity in a distinctly secondary and inferior position.

8. The chief justification for a transfer is the centering of responsibility for all Forest Service work in each region in one man with the advantages that would afford in correlation of Service

activities and in simplification and correlation of public contacts.

After a very careful consideration of the advantages and disadvantages of both forms of organization I have decided to continue the present set-up because I believe by so doing that the Forest Service can make the greatest progress and render the greatest public service.

Since the regional foresters have a voice in the formulation of the investigative programs of all the forest experiment stations, the greatest chance for difficulties or misunderstandings under the present set-up will probably be in the field of extension. Here I wish to confirm the responsibilities and policy already in effect. The primary responsibility of the regional foresters is for the national forests and for the conservation provisions of the forest industry codes which means forestry on privately owned lands. The regional foresters are primarily responsible also for administrative cooperation and extension in the broad sense of the word as applied to both private and State and other public holdings.

The responsibility of the directors of the forest experiment stations is primarily for research. Because of the nature of the work they also have an incidental but unavoidable responsibility for extension. They cannot, for example, deny to inquiries, verbal or otherwise, information which has grown out of their research. They cannot be denied the opportunity to further the cause of forestry in the ways their knowledge and position and standing dictate. With this definition of responsibilities I shall leave it to the good judgment and cooperative efforts of these two groups of men to work out effective extension arrangements locally. Where important Service policies are involved, an attempt should obviously be made to reach agreements in advance of any public pronouncements, and if this proves impossible, to refer differences to Washington for settlement.

Without in any way impairing the independence and freedom of thought necessary for progress, there are undoubtedly ways in which the working relationships between administration and research can be made more effective. This calls for continued thought and effort by regional foresters and experiment station directors, and by the Branches in Washington. As opportunity affords I shall want to devote personal attention to it.

Very sincerely yours,

F. A. SILCOX
Forester.

Yellow poplar reproduction

In May, 1932, a series of semi-permanent quarter-milacre quadrats were established by Abell on the Bent Creek Experimental Forest to observe the progress of yellow poplar seedlings in different environments. The situations chosen were: (1) a moist north slope cut over March, 1931 with yellow poplar seed trees; (2) lightly culled cove forest; (3) overmature cove forest; (4) old field adjacent to (2); and, (5) creek bottom flat burned and clear cut in 1925. This area had poor drainage and was covered by a dense herbaceous growth, particularly ferns.

Best growth and survival was found on locality (1) where a good stand of yellow poplar reproduction started in 1931 and 1932. However, in 1933 and 1934 practically no new seedlings came in. This area was by that time heavily shaded by sprout growth. New trees came in throughout the period on localities (2) and (3) which had rather dense high shade. Except for locality (1) germination was fairly good on all quadrats throughout the period.

In Oct, 1934, survival of 1931 seedlings on locality (1) was 95%, with few 1931 seedlings present on any of the other areas. Seventy-five per cent of the 1932 seedlings survived on area (1) while no other area had better than 20% survival. Seedlings on locality (1) were also tallest for their age, with little difference among the other localities.

Mortality reached no pronounced peak during the summer. Winter killing was somewhat greater under forest canopy than on relatively open areas. It is suggested that part of this is due to the inability of the seedlings under 0.1 foot in height to push their way through the litter. This might also account for the fact that no new seedlings appeared on area (1) in 1933 and 1934.

Scarified quadrats on area (2) showed much higher germination but no better survival than adjoining untreated quadrats.

Trenching of two quadrats in the spring of 1934 increased the growth and vigor of the herbaceous growth, but had no significant effect on the growth of yellow poplar seedlings.

Cleanings

A greater increase in the number of desirable trees and in the number of desirable dominant trees was found on 2 "cleaned" plots 10 years after cleaning than on 2 nearby untreated plots at Lookingglass Rock, Pisgah National Forest, North Carolina.

On this area a stand of cove hardwoods scaling over 40 M per acre, about half of which was yellow poplar, was clear cut in 1913. Abundant reproduction followed. In May, 1916 a severe fire killed back all reproduction. The area came back heavily to sprout growth of silverbell and chestnut with seedlings of sumach and yellow poplar underneath.

In 1924 2 half-acre control plots and 2 cleaned plots were established. On Plot 3 chestnut, silverbell, and dominant sumach were cut and on Plot 4, only chestnut and silverbell were cut. Leaving the sumach had slight if any effect on the growth of the poplar and by 1934 there were only 3 dominant and co-dominant sumach per acre.

These plots show the following values:

Total Number of Trees per acre						
Treated				Control		
Plot No.	Before cleaning 1924	After cleaning 1924	1934	Plot No.	1924	1934
3	4308	1832	1018	1	2138	1122
4	2524	1292	1194	2	2406	916
Number desirable trees (all crown classes) per acre						
3	452	420	728	1	520	730
4	580	580	918	2	412	470
Number desirable dominant trees per acre						
3	136	136	296	1	200	336
4	242	242	368	2	148	190

In 1924 after cleaning the desirable trees on the treated plot had an average d.b.h. of 1.80 inches while the average diameter of the desirable trees on the control plots was 2.23. By 1934 these values had increased to 3.47 and 3.63 inches respectively, making an increase of 1.67 inches on the cleaned plots and 1.40 inches on the controls. This increase on the treated plot was on 223 more trees per acre. Also the greater number of new desirable trees coming in on the cleaned plot undoubtedly lowered the average diameter in 1934 for that plot.

Streamflow and Erosion

Erosion of road banks due to alternate freezing and thawing has been unusually severe in the mountains. The amount of this type of erosion depends on the nature of the soil, the amount of moisture present, and the exposure. Instances have been observed in which as much as a cubic yard of soil has been thrown down by freezing action on a bank 6 feet high within a horizontal distance of 9 feet along the bank. A foliated structure of the clay subsoil, commonly found in the Southern Appalachians, apparently lends itself to the sloughing action of freezing.

Crafton's periodic examinations of road bank planting indicate that only seedlings which have become well established on new soil before the beginning of freezing weather are able to withstand the frost heaving action. In several cases apparently established stands of orchard grass and red top have been completely disrupted and heaved out. The same species in corresponding tests, but with a complete fertilizer, 4-8-4, used at the rate of 400 pounds per acre, was able to withstand the freezing action so far this winter.

The highest 24-hour precipitation since 1918 was reported in Asheville on January 8. Various rain guages on the Bent Creek Experimental Forest showed from 3 1/2 to 4 inches rainfall during a 24-hour period. The ground became thoroughly saturated after the first 2 inches of rain, and all subsequent precipitation produced a very high percentage of stormflow. Numerous small watersheds with a cover of old growth yellow pine which had not been observed to produce any surface run-off in the past five years, showed a conspicuous surface run-off for a period of 36 hours. In many cases the surface stormflow passing through natural branches of the upper slopes swept the loose litter completely away along the channels. The fine roots in the upper mineral soil apparently reduced the amount of actual gullying of the mineral soil.

CALIFORNIA FOREST EXPERIMENT STATION

Forest Management - Pine Region

Experimental Forests

Interest is becoming evident in the Station's plans for advance development of utilization roads. In the Feather River forest the heavy construction work is completed. Less progress has been made in actual construction in the Black's Mountain forest. In the Stanislaus area only the approach administrative road is nearing completion.

In these purely experimental areas the plan is to construct somewhat more elaborate road systems than will be necessary for ultimate utility, exclusive, of experimental needs. About four standards will be used. The primary arterial, over which all travel must pass, will be surfaced. Secondary roads with less traffic usually will not be surfaced. Tertiary spurs of considerable length will be passable for trucks, - shorter ones for tractors and trailers. Some tractor roads will not be passable for trucks. The entire systems will not be built at once, but enough will be constructed to admit of tests to determine the portions justifiable.

Many advantages may be expected from advance development of road systems in timbered areas. Where utilization requirements can be anticipated, construction of all or part of the system will often obviate the necessity of special protection roads, ways, or breaks. Where sales are contemplated, construction of the roads by the Forest Service will promote real competitive bidding. Areas not now merchantable, but in need of treatment, will be made attractive to purchasers. True selective cutting can be practiced where and when necessary. Sanitation will become possible. Very important also, in western pine forests, accessibility may permit really effective bark beetle control with salvage at least paying the costs, if not yielding a profit.

A further consideration, which can no longer be ignored in lumbering, is that properly and permanently located adequate roads will reduce damage from erosion. The common practice of yarding at right angles to the contours, and directly down the drainage channels could not better be designed if intended to promote erosion. The destruction of small meadows and wreckage of small streams will not be condoned forever. Poorly located and improperly drained roads in themselves are a prolific source of soil erosion. Roads to one side of the stream channels and around contours will reduce this damage by shortening the distance logs must be dragged on the ground.

It has remained for code restrictions to bring these possibilities sharply into focus for several lumbermen. The perplexing insect problem is another factor. In the Forest Service protection transportation planning, the fact must not be overlooked that fire protection is not the ultimate aim of land management. In many cases utilization planning should precede protection planning, though the order of construction may be reversed. It is hoped that sufficient progress may be possible in our experimental areas to demonstrate beyond doubt these advantages.

Forestation

Seed Collection

During December 2436 pounds of seed, collected by SERA and CCC boys, were received. The importance of having seed extracted in the field if possible is emphasized by the fact that out of the above collections, 744 pounds which required cleaning at Berkeley yielded only 56 pounds of clean seed.

Cuttings of Baccharis viminea, collected near San Jose, were sent to the Kennett area for planting. Since San Jose is about the northern limit of this species our effort, if successful, will move the species some 250 miles northward.

Germination Experiments

Hastening germination of several species of the genus Ceanothus was obtained by disintegrating the hard seed coat by (1) scarification (2) hot water, and (3) sulphuric acid. Scarified seed of Ceanothus verrucosus gave 72% germination, while plain seed of the same lot did not germinate at all. In the case of C. thrysiflorus, scarification doubled the germination (46% as against 24%). Species of high altitudes did not yield to the simple treatments alone, but required stratification as well. Scarification proved to be beneficial to many legumes. For instance, scarified Lotus americanus yielded 90% germination, while untreated seed gave only 12%.

Vegetative Propagation

Experimental propagation by cuttings of seven species of Arctostaphylos have shown that the most attractive of all the manzanitas, A. stanfordiana is the easiest to propagate. Green cuttings started in December rooted well in one month.

Kennett Area

Reforestation and erosion control in the Kennett denuded area was resumed by Ilch December 4 with a crew of six men.

Biologist E. E. Horn has encountered difficulty in controlling rodents on the area. Chopped pinon nuts dusted with strychnine and placed on the surface of each seedspot proved effective in parts of a 28-acre area, while in other parts the bait was ignored and the seedspots raided. A number of repellants are being prepared for comparison with pretreatment of the area with poisons during early spring. Frequent rains during January so reduced the effectiveness of the rodent control work by leaching the bait that much of the December sowing, apparently controlled at that time, was disturbed by mice after the rains.

Ponderosa and Jeffrey pine seeds were sown on an area of 28 acres, and the seed of various oaks on 20 acres. Six acres were planted with ponderosa pine and Douglas fir nursery stock. Cuttings of willow and Baccharis viminea were set out in two groups of gullies.

A small experiment in terracing on a 42% slope subject to rapid sheet erosion is being installed along the lines of the Italian "gradoni" method. The terraces are being planted with trees, cuttings and seed.

Erosion-Streamflow

San Dimas Experimental Forest

January was characterized by four storms occurring at approximately 5-day intervals. The total precipitation for the month at Tanbark Flat headquarters was 5.93 inches which gave a seasonal total of 21.80 inches at that location. The maximum rainfall intensity always occurred at night, thereby causing the Experimental Forest personnel considerable nocturnal activity.

The low rate of peak runoff resulting from the heavier storms on unburned watersheds is notable. Big Dalton Canyon yields consistently higher peak runoff values than does San Dimas Canyon; Big Dalton Canyon, lying at lower elevations than the other basin, is characterized by somewhat sparser and more xerophytic vegetation.

Summary of Storms
San Dimas Experimental Forest, January, 1935

	Storm Ending			
	1-5-35	1-10-35	1-15-35	1-18-35
I. Rainfall				
Maximum total (inches)	2.64	1.75	2.35	2.02
Minimum total (inches)	1.12	0.59	0.62	0.44
Maximum 10-minute intensity expressed as inches per hour	1.80	0.42	0.72	0.96
II. Streamflow, peak rate in second-feet per square mile:				
San Dimas Canyon	2.0	0.49	1.85	2.61
Dalton Canyon	3.6	0.8	3.2	4.3±

The new "H C F" stage recorders at the large flumes and weirs have proved reliable and sensitive when used with large floats. Some difficulty has been encountered in the large gaging stations which are influenced by road erosion for large volumes of silt and gravel deposit in weir boxes and flume approaches. Alterations to handle debris have been designed.

Ten improved electric water depth gauges, using a milliammeter in place of a neon bulb for registering contact of a point with the water surface, have been installed in the ten large flumes, and are functioning satisfactorily.

For rain-gauge reading the use of Forschner spring balances has been substituted for glass graduates, as the weighing method of measuring rain has been found to be as accurate as volumetric measurement, and more dependable when used by CCC labor. Moreover, it solves the problem of measuring snow and ice.

Surficial Runoff and Erosion Plots

Silt traps of the new type designed by Davis have been installed on SRE plots at Fern Canyon and Tanbark Flat. These traps are equipped with silt flocculating meters automatically adjustable to the rate of runoff.

Flood Investigations

A summary table and map have been prepared by Munson showing results of investigations of rumored floods in southern California following the New Year's 1934 storm. The report includes maps of the watersheds investigated, their areas, fire history, estimated flood flows, and data on topography, vegetation and erosion.

The compilation reveals that recently burned areas produced flood intensities from 5 to 20 times those of unburned areas.

Erosion Survey

In accordance with our general plan for an erosion reconnaissance of the mountain and foothill lands of the State, field work in measuring the silting of reservoirs was begun in December. This information is sought as a basis for determining priorities of more detailed investigations in various watersheds. The first reservoirs examined yielded the following data:

Reservoir	County	Area of watershed (sq.mi.)	Original capacity to spill'y (M-ac.ft.)	Approximate loss in capacity due to silting	Year of first capacity survey
Don Pedro	Tuolumne	1500	266.0	Negligible	1923
Sweetwater	San Diego	181	36.3	20%	1887
Lower Otay	"	112	49.1	Negligible	1919
Devil's Gate Reser'r	Los Angeles	20	4.6	13%	1920
Gibraltar	Santa Barbara	220	13.7	28%	1920
Upper Crystal Springs	San Mateo	9	15.5	Less than 1%	1877

Erosion Control - Mountain Meadows

The Sierra National Forest has submitted the following unanalized data regarding costs of mountain meadow erosion control, accomplished with SERA labor and with technical assistance of the Experiment Station during 1934.

Mountain Meadow Erosion Control Costs - Sierra National Forest

Meadow	Acres	Cost per Acre
Boneyard	25	$ 19.20
Graveyard	138	5.28
Tamarack	70	3.86
Warm Creek	169	3.29
Lower Warm Creek	7	10.51

The Station has under way a detailed analysis of these and similar costs from other Forests.

Runoff-and-Erosion Plots

Increased personnel has permitted closer and more frequent inspection of the SRE plot installations than has been possible in past years. At North Fork two CCC boys have been trained and appointed caretakers of the installation. As a result of careful maintenance, accurate records of rainfall, runoff, and erosion have been obtained for practically every storm of the season. A greater number of high intensity storms have already occurred this season than during any other for which we have plot records.

Snow Study

In order to obtain more complete meteorological data at the Bass Lake installation a snow study has been inaugurated. Current and cumulative snowfall is being measured under different conditions of forest cover in standard raingages with the funnels removed. Snowfall intensity is being measured in a heated, intensity recording raingage. Density changes, melting, and sublimation of the snow pack are being measured from natural snow blocks lying on shallow, drain-equipped pans set on the soil surface. Much of the equipment used is experimental in construction but appears to be functioning satisfactorily.

Fire

All sprouting stumps on the Ponderosa Way are now being treated chemically to prevent regrowth, in line with recommendations by Dr. G. J. Ikenberry who has been studying the control of vegetation through the use of chemicals during the past year. Forty CCC camps are now equipped to use chemicals for this purpose. Ikenberry conducted ten training camps for CCC superintendents and foremen during the month of December. In addition, a manual on the subject was prepared in mimeographed form.

Now that a practical solution to the problem of the control of sprouting stumps is available, Ikenberry will spend the larger portion of his time on a study of the control through soil sterilization of annual vegetation on backfiring strips. Data on the economics of chemical methods will also be collected.

Forest Products

Logging and Milling Studies

A preliminary report containing data worked out by short-cut methods to give a pre-view of the approximate zero-margin tree-diameter limit in east-side pine timber will be completed within a few days. The information is based on the study at the Fruit Growers

Supply Company operation at Susanville, completed the latter part of last November.

The contrasts with the Stanislaus study in respect to the time costs of various woods activities in relation to tree and log diameter are rather startling, as shown in the following comparisons of felling, limbing, and bucking:

Tree d.b.h.	Felling (2 men)		Limbing (1 man)		Cut diam.	Bucking (1 man)	
	Stanislaus	F.G.S.Co.	Stanislaus	F.G.S.Co.		Stanislaus	F.G.S.Co.
	Minutes per tree					Min. per cut	
16	10.4	5.2	5.9	2.5	8	5.9	3.3
18	12.2	6.0	7.1	3.2	12	10.6	4.4
20	14.0	7.3	8.5	4.3	20	22.5	8.4
30	25.2	14.4	23.5	10.7	30	41.7	15.6
40	46.1	23.0	53.0	20.4	40	62.6	27.0
50	75.8	34.5	94.2	33.0	50	85.4	46.5
60	118.3	58.1	156.2	52.2			

Most of the difference arises from method of payment - day labor in the Stanislaus case, contract with the Fruit Growers Supply Co. Fallers averaged 63 m.b.m. gross merchantable scale of Site-2 ponderosa pine per 8-hour day in the Fruit Growers Supply Company study. In the Stanislaus study the average was about 31 m.b.m. per day, all species, Site 1, running around 70 per cent sugar pine and ponderosa pine, and 30 per cent white fir and incense cedar.

CENTRAL STATES FOREST EXPERIMENT STATION

Forest Management

Lumber Code Demonstration of Sustained Yield. The Dubois County, Indiana, sustained yield project has required considerable time of both Diller and Day during the past month. Due to the very limited amount of money now available for this cooperative project, an effort has been made to reduce the field work to a minimum, consistent with the desired results. The Barrett's diameter-height curves suggested the possibility that similar curves might be found satisfactory for individual species in the several types on this project, the objective being the construction of a volume table based on diameters alone, which should materially speed up the field work of the several crews. After some preliminary work, it was decided that this would be possible, provided a separate set of tables was made up for each species in each type. In this manner, the effect of site would be compensated for. Field work has been completed and tables constructed for the more important species in the oak-hickory and the black oak-scarlet oak types.

INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Silvicultural Investigations

Forest Management

Preparation of reports on the following projects has progressed; timber estimate of the Boise Basin Experimental Forest, study of ponderosa pine cut-over areas, effect of forest cover on snow storage and melting, and selective logging compendium for ponderosa pine.

Incidental to these studies, a new local volume table for total cubic-foot volume of small-sized (2" to 10" d.b.h.) ponderosa pine was prepared in alinement chart form. An alinement chart was also made for the purpose of converting diameters inside bark on stumps of various heights to breast-high diameters outside bark. This was used in determining the diameters of trees which had been cut on old sample plots and cut-over areas when it was found that existing tables and rule-of-thumb equivalents were giving values consistently high or low. Although the latter chart was based on local data, it was found by checking against similar measurements in other parts of central Idaho that it could be safely used throughout that territory by applying a local correction factor determined from a few sample trees.

Range Investigations

Spring-Fall Range

Effects of Burning on Sagebrush-Grass Range

Four 10,000-foot transects, each parallel and one half mile apart, were laid out within a tract of sagebrush-wheatgrass range on the northern Snake River Plains near St. Anthony, Idaho in 1932. One hundred estimation plots were located at 100-foot intervals on each transect. These transects are used as partial control for four sections of sagebrush range delegated to a sagebrush burning project which the Intermountain Station is carrying on in cooperation with the State of Idaho and the Fremont County Woolgrowers Association. Data were obtained from the estimation plots in 1932, the area was burned over in 1933 and the plots were reestimated in 1934. During the entire period grazing was prohibited, thus eliminating this influence on the vegetation. The results from the two series of estimations, therefore, are measures solely of the climatic influence during the period of study, and of influences of different degrees of burning.

The random selection of plots resulted in 300 of the total number being located on range with good soil, while 100 fell on lava rock outcrops or "blow-ups", a condition typical of the Snake River Plains. Of the 300 plots on the good soils, 117 were found in 1934 to have been totally unburned, 43 were burned lightly, 72 were moderately burned, and 68 were heavily burned.

All plots were found to have greatly decreased in density in 1934 as compared with 1932. This great decrease was to be expected since 1932 was a year of exceptionally favorable moisture supply during the spring and summer growing season as well as during the preceding winter months, whereas 1934 was a year of unparalleled drought. A reduction of 65.1 per cent in total density on unburned plots compare with density decreases 61.1 per cent during the same period at the U. S. Sheep Experiment Station 40 miles to the west of the area.

The influences of different degrees of burning, however, show distinct effects over and above the great change in density due to drought. Data from the estimation plots are presented below:

Table 1. Per cent loss in density under different methods of treatment, 1934 compared with 1932

Species	Per cent Loss			
	Unburned	Lightly Burned	Moderately Burned	Heavily Burned
Total density	65.1 ± 3.0	78.5 ± 4.5	80.9 ± 3.7	81.8 ± 3.9
Total Grasses	77.0 ± 4.5	74.2 ± 5.8	72.5 ± 5.8	70.2 ± 6.0
Wheat grass	83.0 ± 8.7	71.2 ± 10.3	65.0 ± 8.6	62.3 ± 7.2
Stipas (grouped)	63.6 ± 10.8	75.0 ± 13.9	75.7 ± 14.2	75.0 ± 15.3
Poas (grouped)	95.8 ± 8.2	85.7 ± 13.0	87.5 ± 9.8	87.0 ± 12.0
Total Browse	56.2 ± 3.9	91.7 ± 7.3	96.6 ± 5.0	95.4 ± 5.1
Sage brush	60.9 ± 4.2	94.6 ± 7.1	99.1 ± 5.8	100.0 ± 4.8

The drastic effect of drought is indicated by the unburned plots. Wheat grass (Agropyron daststachyum) and stipas, representing 37 per cent and 35 per cent of the total grasses respectively, lost 83 per cent and 64 per cent of their density due to drought alone. Poas representing 19 per cent of total grasses lost 95 per cent of their density. Sagebrush (Artemisia tridentata) which made up 85 per cent of all browse lost 61 per cent, while total browse and total grasses making up 47 per cent and 45 per cent of the total vegetation respectively, lost 56 and 77 per cent of their 1932 density.

Browse, especially sagebrush, shows a much higher density loss on the burned plots than on the unburned. While not significantly greater, the loss in sagebrush increases in direct ratio to the intensity of burn. Sagebrush was virtually exterminated by all degrees of burning. Observations through the entire area show no sprouting of sagebrush from the roots and very few established seedlings.

Grasses as a whole show progressively less loss in density as the intensity of burn increases. This is especially true of wheatgrass.

When analyzed statistically, the difference between means failed to show significant differences between burn classes for any species or group. However, the difference between total densities on unburned as compared with lightly burned plots is significant (13.4 $\pm$ 5.4) and between unburned and moderately burned or heavily burned plots is highly significant (15.8 $\pm$ 4.7 and 16.7 $\pm$ 5.0). Likewise the difference in densities of both total browse and sagebrush between unburned plots and plots in each of the burned treatments is highly significant, the differences between means being in every case more than four times the standard errors of the differences. Wheat grass density differences approached significance in comparison of unburned with heavily burned treatments. Stipas, Poas, and total grasses failed to show significant statistical differences. The trends, however, are interesting because of their uniformity, and are too closely correlated not to warrant consideration.

Summer Range

Climate and Plant Growth

The date of inception of growth for several of the most important range grasses at the higher elevations, determined by plant development observations over a period of ten years, varied between "early" and "late" years; for Letterman needlegrass (Stipa lettermanii), 50 days; mountain brome (Bromus polyanthus), 45 days, wheatgrass (Agropyron pauciflorum), 40 days. The date when flower stalks were first in evidence varied as much as 36 days for range grasses and 47 days for other herbaceous species. The time of flower stalk appearance is of importance in determining the date at which grazing may begin.

A significant correlation (.820 to .912 for different species) exists between the date when snow disappears and the date when flower stalks are in evidence. Much of the unexplained variation may be accounted for in most instances by variations in the average temperature of the 3 weeks following snow recession. Temperatures higher than average decrease the length of time between snow off

and the appearance of flower stalks; temperatures lower than average lengthen the period. Other factors, such as the extreme deficiency of moisture during the spring of 1934, may override the temperature factor. The above relationships suggest the possibility of predicting, soon after snow recession, the approximate date of range readiness.

Desert Range

Little Growth of Desert Shrubs in 1934

Clear cut evidence of the effect of drought on the growth of shadscale (Atriplex confertifolia), is revealed in measurements of twig and lateral branch growth made during the fall of 1934. Using 5 twigs on each of 50 plants as a representative sample, growth of this important shrub has been measured in four localities in the vicinity of the Desert Branch Station in 1931, 1932, and 1934 as an idea of annual forage yield. A summary of these data is given in the table below.

Average length of twigs (5 per plant) and the number of lateral branches on each twig. (50 plants on each 4 sites).

Site	Cedar Pass		Snake Valley	Antelope Valley	Pine Valley	Average of Four Sites
	Flooded	Dry				
1931						
Length twigs	10.26	6.07	6.48	3.51	-	6.58
No. branches	5.99	3.54	1.78	1.92	-	3.31
1932						
Length twigs	7.94	7.21	5.76	6.56	7.28	6.95
No. branches	3.50	2.20	2.10	2.32	2.54	2.53
1934						
Length twigs	5.31	2.57	1.66	1.41	3.52	2.89
No. branches	4.71	1.56	0.32	0.30	1.36	1.65

As is shown the length of twigs in 1934 was only 2.89 cms. as compared to 6.58 and 6.95 cms. in 1931 and 1932 respectively. Likewise, the number of branches on each twig was 1.65 in 1934 as compared to 3.31 and 2.53 in 1931 and 1932. Estimates of volume of forage made in connection with these measurements indicate that forage production this year is only about 25 per cent of 1931 and 1932. Inasmuch as forage production in 1931 and 1932 was only about 50 per cent of normal, the seriousness of the winter feed situation on the desert this winter can be readily appreciated.

Erosion-Streamflow Investigations

Great Basin Erosion

Treatment to be reversed on historic A & B watersheds

The summer of 1934 marked a change in the experimental treatment of the Area A and B watersheds at the Great Basin Branch Station, the results from which in future years should prove or disprove the concept suggested in Forsling's USDA Bulletin 220 (Influence of Herbaceouse Plant Cover on Surface Run-Off and Soil Erosion in Relation to Grazing) that an increase in plant cover results in favorable conditions of run-off. It may be recalled that when this run-off study was initiated Area A supported a plant density of only 16 per cent whereas the cover on Area B was 40 per cent. Following a period of several years during which the plant cover was maintained at the same ratio by grazing, and during which time run-off records were taken, Area A was then permitted to improve over a period of several years until the plant cover reached the same density as on Area B. A third period followed during which the vegetative cover on both areas was kept as nearly alike as possible. It was on the basis of records from these three periods that Forsling was able to determine that plant cover plays an important role in run-off and erosion.

It is now proposed to overgraze Area B until the density of the vegetation is reduced to 16 per cent, while Area A is maintained with a cover of 40 per cent. It is not known how many years will be required to deplete Area B but as soon as this is accomplished, the duplicate watersheds will be ready for a final trial period to ascertain what influence the reduction in cover may have on run-off and erosion.

Economic survey of David County

Economic Survey

Following the recent disastrous floods in David County, Utah, an economic survey was undertaken as one phase of the investigative work on that area, to determine the economic value of these watershed lands. A few of the salient facts revealed in this survey are as follows:

1. Land inundated by floods since 1923.....1,833 acres
2. Additional land in danger zone.....3,111 acres
3. Total damage in last 10 years.....$1,000,000
4. Mean tangible damage per acre of watershed. 34.00
5. Mean watershed value per acre on income basis 2.80

These data and other information gained in the survey suggest the need for a revaluation of steep mountain watersheds on the basis of their protective aspects.

Relation of Climate to Streamflow

The need for a study of climate and streamflow relationships has long been felt in this region, where water is one of the most essential factors in the economic scheme of things. Until recently, however, suitable records for such a study remained concealed in the archives of unexplored files in the engineer's office of the Salt Lake City municipal water department. After much effort, these data were brought to light revealing 15 years of streamflow measurements on five streams which furnish Salt Lake City with water, with precipitation records from strategic points on these watersheds for the same period. Since each of the five watersheds represent different conditions of topography and cover it is expected that the analysis of these data will bring out some interesting relationships.

Boise Erosion

Soil Losses by Induced Erosion

Although all the data that were obtained with the portable erosion apparatus on the Boise River watershed last year have not yet been completely analyzed, the analysis of one portion of the data has been carried far enough to show the extent to which nitrogen, and organic and colloidal material can be leached from granitic soils by surficial run-off. The following table based on soil samples taken from plots and from eroded silt in connection with 96 measurements of run-off and erosion induced by artificial rainstorms, is self-explanatory:

	Soil Samples (0 - 1/2 inch)		Eroded Silt
	Before rain	After rain	
	%	%	%
Total nitrogen	.172	.114	.277
Organic matter	3.68	3.03	6.46
Colloids	11.7	11.0	18.4

According to Fishers "T" test, all values in the table are significant. Although the absolute reduction in the amount of these essential elements in the soil is small, the relative amounts removed in the silt in each case exceeds 200 per cent with respect to nitrogen and organic matter, and nearly this much for colloids, thus indicating a high differential loss by erosion of the most valuable soil fraction.

Vegetative Trends on the Boise

Studies of range vegetation on the Boise River watershed in connection with streamflow investigations reveal that drought and grazing in recent years have further diminished the plant cover on that area. Using density as a criterion of range improvement and range denudation, the average trends of over 100 major plots from 1931 to 1934 are as follows:

Class Vegetation	Density trend in per cent	
	Protected	Grazed
	%	%
Total Density	-7.5	-32.5
Grasses	0.0	-29.4
Weeds	-18.8	-29.4
Browse	+7.7	-41.2

(Table includes only perennials)

The failure of ungrazed vegetation to increase in density during this period obviously is due to climate whereas the substantial decrease in density of grazed vegetation must be attributed to the combined influence of both climate and grazing.

When these values are converted into terms of forage acre factors, the effect of grazing is scarcely less significant, the value of all protected plots having increased 7 per cent while the grazed plots decreased 22 per cent in forage value.

LAKE STATES FOREST EXPERIMENT STATION

Enlargement of Upper Peninsula Station Approved

At the recent meeting of the National Forest Reservation Commission, purchase of an additional 4,100-acre tract at Dukes, Michigan, for experimental use, was approved. Involved in this purchase was over 3,000 acres of virgin northern hardwoods. At last the Upper Peninsula branch is on a basis which will make possible a demonstration of sustained yield management. Not only did the Commission approve the purchase of this area, but asked that a 10,000-acre purchase unit be blocked out with the experimental forest as the center.

Supplemental Planting on Cut-over Hardwood Land

Recent measurements of white pine plantations at the Upper Peninsula branch station in Michigan bring out some interesting figures. Five acres of hardwoods were logged by clear-cutting in 1920. The advanced natural reproduction was spotty and additional openings occurred in skid trails. White pine was planted in these openings in 1929. Transplant stock (2-2) grown in Michigan was used. About 200 trees per acre were set out. At the end of six years, this planting is highly successful, due in no small measure to frequent release cuttings. The survival is 70 per cent and the average height is 5.9 feet. Some of the trees are 12 feet tall. The pines have kept pace with the hardwoods and are now leading the hardwoods in growth. The stems are exceptionally thick, the needles a good green color, and the plants in general look very healthy. Most of the mortality was the result of heavy rabbit damage during the first two years in the field.

Shelterbelt

The work of assembling data for the report on the possibilities of shelterbelt planting in the Prairie-Plains region is progressing. A preliminary report by Bates has already been submitted to Washington.

Seed Studies

Professor R. B. Harvey, of the University of Minnesota, has been appointed as Agent to help with Shelterbelt seed studies. Dr. Harvey will give one-third of his time to the work, and will undertake investigations of the effect of chemicals on seed, with the object of determining if possible a means of speeding up germination. Other investigators have found a number of chemicals which

are able to hasten germination of certain species. An attempt will be made to synthesize some new chemicals which it is hoped will hasten the germination of some of the species contemplated for shelterbelt planting, many of which are very slow to germinate.

In order to accommodate the expanded work along seed lines, the Station's laboratory is being remodeled to make the conduct of the work more efficient. Automatic temperature control is being substituted for manual control, in order to provide greater precision, and the space available for seed testing is being increased.

Thinnings in Jack Pine and Aspen

The compilation of the first five-year remeasurement of several thinning plots in 20-year old jack pine on the Chippewa National Forest has shown that basal area increment increases with severity of thinning up to a cutting as heavy as 60 per cent of the normal basal area. Such heavy thinnings have always been expected to yield smaller basal area increment, although perhaps higher rates of D.B.H. growth on individual trees, but these plots show that this is not true in all cases.

Thinnings in aspen were carried out on the Chippewa National Forest in 1929. The first remeasurement of these plots indicate that heavy thinning, a 20 x 20 foot spacing of the selected head trees, produces almost as much basal area increment as the unthinned plot, but not so much as the plots thinned 10 1/2 x 10 1/2. The object of this study is to develop a method of producing large aspen at an early age before decay sets in.

Killing Temperatures for Seedlings

A manuscript detailing the results of studies of killing temperatures for young seedlings under laboratory conditions was completed. It was found that under conditions of high humidity seedlings were killed or injured at lower temperatures than with low humidity. This result indicates that transpiration has a cooling effect and protects the plant from high temperatures. This evidence is of particular interest at this time since the effect and purpose of transpiration has been a subject of much debate lately, and clear-cut evidence demonstrating any of several possible theories has been largely lacking.

NORTHEASTERN FOREST EXPERIMENT STATION

General

Hale Report:

Behre spent half of January in Washington on final revision of the Hale Report which had taken several weeks of his time during the fall. The Hale Report deals with the national pulpwood situation. It shows that dependence on imports which amounts to more than half of the wood equivalent of all pulp and paper consumption is largely the result of traditional preference for spruce. Technical developments point to a much wider use of other species in all pulp classes and indicate great possibilities for the pulp and paper industry in the Pacific Northwest and in the South. Forest resources of the nation are fully adequate to supply all present and prospective pulp and paper needs but requirements for pulpwood must be coordinated with those for lumber and other forest products. The report stresses the advantages of integration of pulp and lumber industries, and also the importance of maintaining adequate growing stocks to insure sustained yield sufficient for all needs. If properly handled, expansion of the pulp and paper industry with the objective of attaining a large measure of independence of imports would not only be of benefit to conservation, but would have many desirable economic and social aspects. Several demands have already been received for the report and it appears that there is likely to be considerable pressure from certain quarters for a tariff on pulp.

Cooperation, White Mountain National Forest:

Westveld spent a week on the White Mountain National Forest, assisting the administrative organization in planning and laying out a series of sample plots to study the results of cultural operations by the Civilian Conservation Corps. Girdling operations such as have been practiced over extensive areas in the White Mountain require different form of sampling to get an adequate record of the results of the treatment.

Management of Spruce

Westveld has been in Washington since the middle of October and has been engaged in the statistical analysis of his data on volume growth of cut-over spruce lands. He has developed a multiple regression equation in which the volume in cubic feet is a function of the number of years since cutting, density as measured by an index developed specially for the purpose, the proportion of conifers to total stand, and the basal area per acre of conifers. His data

give a correlation coefficient of .91 before correction of curvature. From this study Westveld expects to evolve yield tables which will apply to the wide variety of conditions which occur on cut-over areas in the spruce flat type.

Biology

Miller attended the American Game Conference in New York City during January. He reports increasing interest in game management work by the Civilian Conservation Corps on the Massachusetts State Forests. The number of demands on his time for advisory service and contact work, in addition to the development of the Pillsbury Forest in New Hampshire, for experiments in the interrelation of wild life and forest management, make it almost essential that assistance be provided for his work.

Botany-Phenology

Some of the effects upon vegetation of the abnormally cold weather during the winter of 1933-34 are given below:

Connecticut: Northwestern-

Laurel, hemlock, and wild and cultivated grape were damaged to a slight extent; privet, red pine plantations (planted in 1933) Japanese maple, and rhododendron suffered considerably, and an occasional catalpa was killed. With few exceptions all vegetation in open or in exposed places, or which was planted within a year, were damaged more than the vegetation in sheltered places or which was planted prior to 1933.

West Central -

In the more exposed areas as on the tops of ledges, the tops of scrub oak, chestnut oak, and some red oak were winter-killed.

Southern -

Privet hedges were killed back and some coniferous ornamental stock was "burned."

Massachusetts: Northern-

In some sections the cold weather in May, rather than the extreme low winter temperatures, is believed to have caused considerable damage to vegetation. Privet hedges were heavily frosted and died back at that time. Hardwoods and conifers on higher and drier sites did not suffer from the cold weather as much as those on lower and more moist sites.

Southwestern-

In some sections the native plants did not appear to be damaged to a great extent, although the ornamental plantings and apple trees were damaged considerably.

Northwestern-

There was one gallon of maple syrup to one barrel of sap this year as compared with one gallon to one and one-half barrels of sap in previous milder winters. A good many needles of white pine and hemlock that were exposed to the sun in the late winter and early spring turned brown and fell off when the new growth began. In some cases the damage was so severe that the tips were killed. In some cases, especially where thinning was practiced, there was considerable damage from snow and wind to the limbs of white birch and aspen. The boles of young red maple and aspen suffered more frost crack than normally. Heavy snowfall crushed and deformed at least two spot plantings of jack pine, 12 years of age, on a well sheltered southeast slope. Red and Norway spruce, Norway, Austrian, and white pine in plantations were also damaged by wind and snow.

New York: Northern

Tupper Lake: In some areas blueberries (Vaccinium) were killed back to the root crowns. A few red maple saplings were killed back to such an extent that sprouts from root crowns and stems resulted, giving a most striking appearance to the stand.

Newcomb: Hemlock, red spruce, balsam fir, and white pine were winter-killed. Hemlock was affected most, white pine the least. Mature beech at edges of clearings and sapling red maple on old burns were winter-killed. Frost on May 24th killed back newer leaves and shoots of Viburnum, maple, and beech. Foliage of brake fern, beech, and yellow birch were severely damaged by frost on June 7.

Cranberry Lake: A thousand acre stand of small hardwoods was so severely damaged that the area appears to be burned. Beech was injured most severely, some as large as 16 to 18 inches d.b.h. being killed. Birch and maple were also severely injured.

Southern -

Ornamental stock including privet, arbor vitae and white pine were severely damaged in certain localities.

Maine: Central -

Elm in some localities and red maple in the lowlands were winter-killed to some extent. Red maple in various localities produced false or premature flowers which dropped before any fruits were found. Conifers, especially those on northern slopes, were slightly damaged. The 1933 needles of white pine were sometimes killed. In some localities the clusters of terminal buds on the leaders of 5 to 15 year old white pine were killed. Frequently adventitious buds were formed and growth resulted from these. Very little damage was observed among the herbaceous vegetation, altho considerable damage was done to cultivated shrubs.

Silviculture

Information is now available regarding certain aspects of fire injury and restocking following fires in the western white pine type. These figures are the result of annual examinations on a 3-acre permanent sample plot established immediately after one of the bad forest fires of August 1926 on the Kaniksu Forest. In this particular spot the fire did not burn intensely enough to crown, but did kill some of the trees outright and badly fire-girdled most of the others, save the thick-barked larches. The original forest was a heavy mature stand with some trees up to 40 inches or more in diameter.

64 per cent of the white pines were killed outright by the fire. The remainder were mostly severely injured at the root-collar and died from this cause gradually through the years following the fire. Eight years after the fire there are only two trees per acre or six per cent of the original white pines alive. In the meantime the trees that have gradually succumbed to the injuries have produced some seed and started some white pine reproduction on the area.

A striking example of resistance to fire injury and high effectiveness as seed producers after the fire is furnished by the larches. Only two per cent of these trees were killed outright and 86 per cent of them are still alive and vigorous. The next most resistant tree, of which there are 40 per cent still alive, is Douglas fir, figures for which are not given separately in the table. The thin-barked trees like Engelmann spruce, alpine fir, and lodgepole pine were killed directly or died in the first few years after the fire; none of them remain alive today.

TABLE 1 Trees over 10.6" d.b.h. alive each year following forest fire in 1926 to show availability as seed source

Species	Stand per acre bef. fire Aug. 1926	Number of trees alive per acre								Percent of original stand alive in 1934
		1927	1928	1929	1930	1931	1932	1933	1934	
W. W. Pine	31.6	18.7	10.0	5.7	5.3	3.9	3.3	3.0	2.0	6
W. larch	17.5	17.2	16.5	15.9	15.9	15.9	15.3	15.0	15.0	86
Others	28.7	17.7	12.0	9.4	9.1	8.7	8.0	7.4	4.3	15
Total	77.8	53.6	38.5	31.0	30.3	28.5	26.6	25.4	21.3	27

TABLE 2 Seedlings started by above trees

Species	Number of seedlings germinated per acre by years								Total germinated	Total alive in 1934 of all seedlings over 2 yrs old
	1927	1928	1929	1930	1931	1932	1933	1934		
W. W. Pine	694	278	83	111	139	0	28	28	1,361	417
W. Larch	23,444	750	1750	4944	17,861	2250	555	3195	54,749	13,417
Others	8,334	334	195	2112	195	111	84	333	11,698	4667
Total	32,472	1362	2028	7167	18,195	2361	667	3556	67,808	18,501

From the tables it is evident that even among the easily injured white pines there were ten trees per acre alive two years after the fire and five trees four years after. During these years these trees started an average of over a hundred seedlings a year. It is important to point out, however, that the white pine reproduction of the first year and possibly some of that of the second year started from seeding by the full overwood during the year of the fire. There were good white pine seed crops in 1926, 1929 and 1932. Larch stands out as the most effective species for restocking after fire on this area as it does wherever it is an important component of the white pine type. Not only have the larch trees seeded abundantly, but seed years have been frequent.

Of all the established reproduction, larch comprises 75 per cent, Engelmann spruce 12 per cent, white fir nine per cent, lodgepole pine three per cent, white pine two per cent, and miscellaneous species one per cent. Although the white pine reproduction makes up only two per cent of the total this represents 417 seedlings per acre, stocked in terms of 4-mil acre units. In view of the ability of this species to assert its dominance in young growth stands, this stocking should lead to a reasonably favorable amount of white pine in the mature stand.

The total of 18,501 seedlings of all species per acre on this plot makes for an exceedingly satisfactory stocking of the area. In drawing conclusions from these data, it must be kept in mind that there were a considerable number of larches in the stand, that the fire occurred in a year of bumper seed crop, and that the following year was exceedingly favorable for the establishment of reproduction. Without the coincidence of a heavy seed crop and a favorable year for reproduction, there would not have been so heavy a seedling stand, but as can be seen from the table there would still be sufficient regeneration to stock the area satisfactorily. The important feature of gradual seeding in fire-injured and beetle-attacked trees that later die, is believed to be the usual occurrence after forest fires in this region.

Plans were prepared by Davis for the making of two small timber sales in the Deception Creek Experimental Forest. These sales are scheduled for next summer and will initiate a program of closely supervised yearly cutting within the experimental area.

One sale provides for the removal of a white pine seed-tree stand from an area cut over fifteen years ago. Excellent reproduction carrying a good proportion of white pine has come in and the seed trees are no longer needed. Following logging, the reproduction will be thinned to favor white pine. Establishment of a series of random block thinning plots to study the effect of different degrees of thinning is also planned.

In the other sale, a very high quality mature (161 - 200 years) mixed white pine stand is to be cut, leaving alternate clearcut and shelterwood strips. The expectation is that the shelterwood strips will seed in both the area under the shelterwood and the adjacent clear-cut strips. On some nearby strip cuttings made in 1910 the clear-cut strips reproduced remarkably well but intervening uncut strips did not reproduce at all, which will make a seed cutting necessary to open up the stand to let in reproduction before the veteran overwood can be entirely removed. The strip shelterwood system should overcome this difficulty. Following logging, all species other than white pine will be felled. Brush will be disposed of by both broadcast burning and by progressive piling and burning. A series of quadrats and seed traps will be installed to study where, when, and how much reproduction comes in following the cutting.

It is planned to administer these sales by a cooperative arrangement between the Experiment Station and the Coeur d'Alene National Forest.

Statistics

Hinton completed the wholesale and retail lumber price reports for the fourth quarter of 1934. The recent stimulation to the lumber industry because of the increased demand of public works projects and private building is reflected in the wholesale lumber prices reported by the Western Pine Association for December. The following comparison of prices for November and December shows December prices for white pine and ponderosa pine have dropped off $2.07 and $0.54, respectively, which is attributed to substantial increase in sales of lower common grades for construction purposes.

	Nov. 1934	Dec. 1934	3rd Qtr 1934	4th Qtr 1934
Idaho white pine	25.05	23.98	26.14	24.83
Ponderosa pine	21.96	21.42	22.52	21.63
Larch-fir	17.18	16.12	18.09	16.80
Spruce	17.27	17.47	18.53	17.44
White fir	12.25	13.17	14.17	12.66

Range Research

Compilation of quadrat, plant development, cattle weights, and other range data has now reached the point where analysis and comparisons can be started.

Miles City precipitation of 5.51 inches during 1934, was 8.28 inches below normal and the driest in 57 years of record while the mean annual temperature of 50° was the highest in 43 years. Up to 50 per cent of the grama grass clumps failed to make any growth and no seed heads were produced on those that did start growth. All of the important grasses were dormant by June 15, or earlier, and remained so until October, when three of the grasses produced a very little growth as a result of late September rains. Total production of range feed did not exceed 20 per cent of the 1932 volume and appeared to be deficient in some mineral which caused cattle to consume salt and bone meal in amounts about three times greater than normal.

The 60 experimental cows used all the available forage from their yearlong pasture, besides varying quantities of supplemental feed, and had to be placed in the feed lot in November. The poorer cows from the overgrazed pastures are wintering quite satisfactorily on 20 to 25 pounds of medium to poor alfalfa and sweet clover hay.

A report has just been completed recommending the establishment of an Experimental Range in the western part of the State of Montana, which will contain 158,000 acres of foothill spring-fall range. About 85,000 acres of this area are public domain. Some measure of soil depletion on this area is indicated by the fact that original top soil now covers only about 6 per cent of the surface, the remainder being occupied by subsoil and rocks. Rehabilitation of such an area presents some major range land-use problems.

The recent convention of the Montana Woolgrowers adopted a resolution favoring regular, rather than emergency, type of federal financing of an adequate research program, looking toward rehabilitation of overgrazed and plowed and abandoned range lands.

PACIFIC NORTHWEST FOREST EXPERIMENT STATION

Legislation

Both the Oregon and Washington State Legislatures are now in session and forest legislation proposed includes measures relating to deferred timber taxation, sustained yield forest units, zoning of forest and grazing land, transfer of county lands to State or Federal Government, quieting title on county tax foreclosure lands, cancellation of delinquent taxes on lands transferred to the State or Federal Government, etc.

Section of Silviculture

Fire Studies

Copies of a detailed analysis of lookout discovery time were sent to the supervisors. Matthews had an interesting and instructive field trip to the Port Orford cedar slash area on Sandy Creek in Coos County which the Bradford CCC Camp is cleaning up this winter. The Experiment Station is giving technical advice on the project and observing the results. In the party were Cronemiller, Cowan, MacDaniels, and Wright; some lively discussions took place about the hazard left by selecting Port Orford cedar out of the stand and about the slash problem in partial cuttings in general.

Experimental Forests

The office work in connection with the cruising done on the Wind River Experimental Forest was completed toward the end of the month. The Pringle Falls and the Cascade Head projects now partially done will be finished sometime in February. The computing work on the several projects is being rushed so that the information can be used for the preparation of a detailed plan of research for each area this winter.

Cruising has been initiated on a tract of some 6,000 acres on the Siskiyou National Forest in Coos County in order to have information upon which to negotiate for a Port Orford cedar natural area and possibly a demonstration area. ECW foremen and CCC men will be used on this project.

Isaac has designed a new type of informational sign for experimental areas. The feature of the sign is an inside weatherproof compartment where a plot of the area and a one page summary of results can be posted to supplement the general information on the outside of the sign. They should be particularly useful on

experimental plantings, thinning plots, growth plots, and similar areas where results are accumulating and can be brought up-to-date and posted from time to time. Blue prints can be obtained upon request.

Douglas Fir Silviculture

During the month of January, Miss Jean Kerr, Assistant Editor from Washington completed the editing of two manuscripts for publication in the Journal of Agricultural Research. One report, "Forest Soil of the Douglas Fir Region and Changes Wrought Upon It by Logging and Slash Burning" by Isaac and Hopkins, reports one of the few pieces of work done on the forest soils of this region. It points out that burning sweetens the soil and makes some plant nutrients more readily available, but associated with this there is a tremendous loss of soil organic matter and nitrogen and a partial loss of other plant foods. The other report, "Seedling Establishment in Relation to Certain Environmental Factors on Logged Areas in the Douglas Fir Region" by Isaac, covers a four-year study to determine the amount and cause of Douglas fir seedling loss on broadcast burned cut-over areas. It points out that a more adequate seed supply and more favorable ground conditions must be provided if more satisfactory natural regeneration is to be obtained.

Forest Survey

The Survey received a supply of its lithographed 1/4-inch-to-the-mile base maps for the northeast and southeast quarters of Oregon and Washington from the U.S.G.S. These maps were made primarily to furnish a skeletonized base map of culture and drainage upon which at a later time the distribution of the several forest types will be printed in colors. This advance issue, which is to be used for general base map purposes, has been distributed to a large number of agencies and individuals in Oregon and Washington.

Rapid progress has been made on the reducing and generalizing of the 1-inch-to-the-mile maps for the northwest quarter of Oregon in preparation for the lithographed colored type map to be printed by the U.S.G.S. The generalized 1-inch-to-the-mile maps have been reduced and traced onto the lithographer's copy for about 70 per cent of this quarter of Oregon, and it is expected that this material can be shipped to Washington for lithographing by the middle of February. Type and base legends, including definitions of types, explanatory notes and titles for these maps have been worked out. Generalizing and photostatic reduction of the same type of data is well along for the southwest quarter of Oregon, and some progress has been made in transcribing these data to the lithographer's non-photographic blue chart paper. About half of the territory involved in the northwest quarter of Washington has been prepared. The southwest quarter of Oregon and the northwest quarter of Wash-

ington should be completed and ready not later than March 15. A great deal of interest in these 1/4-inch-to-the-mile lithographed forest type maps has been evidenced by a large number of individuals and agencies in the region.

January saw a large number of requests for Survey data and Survey maps from all types of people, ranging from cooperage and timber companies, Japanese lumber companies, the War Department, the A.A.A., land consultants, Eastern pulp and paper companies, and the Regional Office.

Douglas Fir Region

Steady progress has been made on the reports, with the bulk of the permanent Survey staff still at this job. Basic computations for anticipated depletion and growth are practically finished and further progress on the regional reports in addition to that on the individual unit reports can now be made.

Ponderosa Pine Region

Moravets, with the help of ECW men, has been working on the status of ownership for all of the territory east of the summit of the Cascades covered last field season. The same vexing status of ownership problems which occurred in the Douglas fir region are again present on the east side. Most of these have been solved, with the exception of the status of public domain, which is now being obtained for the Survey by the Washington Office. Another group of men is working on official land office areas, and in this connection many new problems are arising due to the drying up of areas formerly considered as marshes and lakes.

One-inch-to-the-mile type maps have been made and hand-colored for all of the area in eastern Oregon for which field work was done last season, and similar progress has been made on most of the area covered in eastern Washington.

Protection - Fire:

The Roberts plots, originally established in 1915, were remeasured again in November, 1934, and an analysis of the records to date has just been completed by Bull. The plots were established on cutover longleaf land heavily stocked with 15-month-old longleaf seedlings from the 1913 seed crop. Plots U-6 and U-7, each one-fourth acre in area, were fenced at establishment, and since that time Plot U-6 has been completely protected from fire and Plot U-7 has been burned over annually in winter. All analyses and reports to date have shown or implied that the stand on the unburned check plot is far superior to the stand on the annually burned plot in practically every usual item of comparison -- number of trees, basal area, average and maximum diameter, average and maximum height, etc. These analyses and reports have been based on the total stand (per plot or per acre) and on that basis they are correct and indisputable, in 1934 as well as at earlier dates. The total stand present at early ages -- and the trees on the Roberts plots were only 21 years old in November 1934 -- cannot and does not remain intact to merchantable maturity. A comparatively small fraction of the 1,656 and 1,820 pines now present on the two plots, U-7 and U-6 respectively, will be present when the stands as a whole are merchantable. Since (1) a large number of pines now present will die through crowding and suppression before attaining merchantable size, and (2) in comparing total stands at an early age, we evidently included a large proportion of trees, basal area, cubic volume, etc., that have no direct bearing on the eventual merchantable stand, the analyses just completed have dealt only with "potential crop trees."

Granted that the actual eventual crop trees cannot be selected at the present time, there are several methods by which one may select groups of trees that will undoubtedly contain a very large number of eventual crop trees. A comparison of recent growth rates for such selected groups of trees should afford a more significant test of the effect of the two treatments than is obtained by comparing total stands. Three different (but overlapping) groups of pines were accordingly selected on each plot and the average growth in d.b.h. and in height of each group for the last 4 and 5 years was computed. The three groups were: (1) the dominant pines, as of 1934; (2) the 200 largest pines per acre, in respect to d.b.h. as of 1934; and (3) the 100 largest pines per acre, in respect to d.b.h., as of 1934.

The correlation between d.b.h. five years ago and d.b.h. growth during the past five years was computed for each group of dominant pines and the correlation of height and height growth was similarly computed. The significance of the differences between various items of average growth was computed for each selected group. The conclusions are of considerable interest.

The larger potential crop trees on the annually burned plot have been growing faster in both d.b.h. and height during the past 4 and 5 years than the larger potential crop trees on the unburned plot. In the case of the present dominant stands, and the 100 and 200 largest longleaf pines per acre, the differences in favor of the burned plot are statistically highly significant. In the case of the 100 and 200 largest pines of any species per acre, the differences in favor of the burned plot are not statistically significant. Some 24 to 64 per cent (depending on the method of selection) of the potential crop trees on the unburned plot are loblolly and shortleaf, and the remaining 36 to 76 per cent are longleaf, whereas on the burned plot 100 per cent of the potential crop trees are longleaf. The growth trends of the past 4 and 5 years, and the present stand conditions, make it appear not only likely but very probable that the eventual crop trees on the burned plot will be as large or larger than those on the unburned plot.

Management

Fire

Field work on a general controlled fire and thinning study in young slash pine stands was started at Cogdell, Georgia on the property of the Timber Products Co. This company plans to thin 15 to 20 thousand acres of young slash. In the present plan of thinning in which about 1500 trees per acre are left it is doubtful whether the fire hazard is materially lowered as previous study has shown that hazard is but little affected until stand density is reduced to less than 1,000 trees per acre. Immediately following thinning of these young stands a controlled fire is used to reduce the hazard. The thinning slash being still green does not make a hot fire and the residual stand, although only 8 to 15 years old, is not damaged appreciably.

In order to study the combination of thinning and controlled burning, four areas were selected and on each six sample plots were established. Data on the following points will be obtained.

1. Relative costs of thinning areas having 1,000 to 50,000 trees per acre to:
    A. 300 to 500 trees per acre
    B. 800 to 1,600 trees per acre

2. The effect of the two degrees of thinning on subsequent growth.

3. Effect of controlled fire on growth of the residual stand.

4. Development of underbrush following fire.

Fire and Soil Studies

Preliminary analysis of four study areas failed to reveal a difference in water holding capacity in soils from burned and unburned areas. Wilting coefficients of these same soils are now being determined. Germination of slash pine seed in burned and unburned soil is also now in progress.

Forestation

Wakeley, Olsen, Huberman and McKellar continue directing the lifting and planting of the spacing and survival studies on one of the experimental tracts of the Kisatchie National Forest, the work being done by CCC boys. Since December 13, approximately 190,000 trees have been planted. A freeze on January 21, accompanied by a six-inch snow-fall, delayed work five days and injured some of the slash pine planted three and four days previously, but did not seem to have affected alash or longleaf pines planted earlier or those held in the heel-in-beds during the freeze.

Financial Aspects:

A case study of naval stores in southern Georgia, showed that mortality of turpentined trees is highest in the smaller diameter classes, amounting to as much as 14.5 per cent per year in seven inch (measured 8-1/2 feet above the ground) slash pine trees in the ponds, but decreasing to 1.4 per cent in 10 inch trees. A similar relationship was present in both longleaf and slash pine in the flatwoods. The accompanying table gives the mortality of turpentined trees. Round trees, however, showed a very small mortality.

Table 1 - Annual mortality for turpentined slash and longleaf pine in southern Georgia.

D. B. N. 1/	Flatwoods		Pond
	Slash	Longleaf	Slash
	.....Per cent.....		
7	10.5	10.0	14.5
8	5.8	2.5	6.2
9	2.9	1.3	3.0
10	1.2	0.7	1.4
11	0.4	0.5	
12	0.1	0.4	

1/ Diameter at 8 1/2 feet above the ground, which is above the turpentine face.

The mortality given in Table 1 does not include cup mortality due to dry facing. Table 2, however, shows the percentage of working trees dy diameter classes that have dry faced during the past year. Here again, the loss is chiefly in the smaller turpentined trees. The large percentage of small turpentined trees lost through death and through dry facing, strongly points to the fallacy of cupping trees below nine or ten inches in diameter (8-1/2 feet above the ground). If trees were not cupped until they were nine or ten inches in diameter, the yield of gum per tree would be larger and the worked-out trees would be of sufficient size for utilization as saw logs or for other forest products.

Table 2 - Annual dry facing of turpentined slash pine in southern Georgia.

D. B. N. 1/(p.41)	Flatwoods	Pond
	Slash	Slash
	.....Per cent.....	
7	10.6	4.5
8	4.6	3.3
9	2.8	2.4
10	1.7	1.6
11	1.0	0.8
12	0.5	0.2
13	0.1	

1/ Diameter at 8 1/2 feet above the ground, which is above the turpentine face.

Forest Survey:

The field work of a Forest Meter Survey of Unit #1 Georgia was completed by Jr. Foresters Smith and Stover. This study was made to see if (1) the Forest Meter Survey with sufficient ground work can be substituted for the present line plot system of the Survey, and (2) if it can be used to forecast naval stores croppage and yields.

Entomology:

Dr. T. E. Snyder reported the following activities:

1. Inspection of termite damage to buildings, (textile mills and houses) for Roberts & Company of Atlanta, Ga., at West Point, Ga. Loom vibration appears to protect wood in the immediate vicinity from termite attack. The recommendations for remedying and preventing attack will save many thousands of dollars to the mill owners.

2. Inspection of termite damage to buildings of U. S. Army Engineers, 2d N. O. District, and outline of remedial measures. From $1,000 to $1,200 will be the saving effected over the original plans for repairs. Biological data of interest obtained on tube building.

3. Inspection of Forest Service Buildings on the Harrison Experimental Forest Area, Mississippi, to advise on further termite-proofing of buildings.

4. Planning chemical sprays and dips (tests) to protect green lumber from ambrosia beetles.

5. Rearing several different types of powder-post beetles affecting lumber and the woodwork of buildings and study of their biology.

Pathology

Hatfield reports that the study of the methods by which sap-stain organisms are disseminated was continued during the month, especial emphasis still centering around the effect of wind on dissemination.

Green pine sticks and culture dishes containing malt agar were exposed at various places in the mill for like periods of time. Identification of the organisms obtained is now in progress. Although the cultures are not well enough developed to warrant definite statements, it appears that, under the conditions of the experiment, the population type is far more restricted on the wood surfaces than on the agar. If this proves to be true, it may be explainable by the fact that the agar surface is probably more retentive than the wood surfaces, and not attributable to the fact that there are less or a different kind of fungi suspended in the air that passes over a given culture dish than in the air surrounding a stick exposed under conditions similar to the conditions around the dish.

MANUSCRIPTS

PACIFIC NORTHWEST

Isaac, Leo and Howard G. Hopkins	The Forest Soil of the Douglas Fir Region and Changes Wrought Upon it by Logging and Slash Burning. (For J.A.R.)
Isaac, L. A.	Seedling establishment in relation to certain environmental factors on logged areas in the Douglas fir region (For Journal of Agricultural Research)
Rapraeger, E. F.	Deterioration and utilization of fire-killed Douglas fir.

APPALACHIAN

Nelson, Ralph M.	What is Fire Damage? Address before North Carolina Forestry Association, Raleigh N. C., February 7, 1935
Jacot, Arthur Paul	The Species of Zetes (Oribatoidea-Acarina) of the Northeastern United States. (N. Y. Ent. Soc.)
	Northrus kornhuberi (Oribatoidea-Acarina) rediscovered through a grant of the Elizabeth Thompson Science Fund. (Biological Institute, Tohoku Imperial University, Japan)
	Wild Life of the Forest Carpet (For Scientific Monthly)

INTERMOUNTAIN

Bailey, R. W.	Shackling the mountain flood menace (For American Forests),
Bailey, R. W.	Epicycles of erosion in the valleys of the Colorado Plateau Province (For Journal of Geology)
Mowat, E. L.	Growth on selectively cut ponderosa pine stands (Payette National Forest.) Mimeograph report.
Pender, T. C.	Timber stand improvement in the ponderosa pine type. Mimeographed report.

IN PRINT

Abell, Margaret S.	Use of the Craighead Diameter Tape for Trees Under 1.6 inches in Diameter. (Jour. Forestry, Jan. 1935).
Appalachian Station	A method for Rating Forest Fire Intensity. Tech. Note No. 8, A. F. E. S. (Jan. 1935)
	Effects of a Light Fire on Loblolly Pine Reproduction Tech. Note No. 9, A.F.E.S., Jan. 29, 1935
Jacot, Arthur Paul	Two species of Lichen-Mining Mossmites, Ann. Ent. Soc. Am. vol. 27, pp. 462-467, figs. 1-8. Sept. 1934.
	The Mite Oribata lamellata and Related Species, Records Australian Museum, (Sydney), vol. 19, pp. 181-183, figs. 1-6. Sept. 1934
	An Intertidal Moss Mite in America. Jour. N. Y. Ent. Soc. vol. 42, pp. 329-336, pl. 20.
	A New Four-Horned Mossmite (Oribatoidea-Acarina). The Am. Midland Naturalist, vol. 15, pp. 706-712, figs. 1-13, Nov. 1934.

Pearson, G. A.	Timber Stand Improvement in the Southwest (Jour. For. Feb. 1935)
Reineke, L. H.	A Movable, Constant-Orientation, Lookout Mapboard. (Jour. For. Feb. 1935)
Sims, I. H. and E. F. McCarthy	The Relation between Tree Size and Mortality Caused by Fire in Southern Appalachian Hardwoods. (Jour. For. Feb. 1935)

TRANSLATIONS

Beplantningsforsoeg Paa Et Affoegent Sande Haarup Sandflugt Ved Silkeborg (Planting Experiments in a Territory of Drift Sand. Haarup Sand-Drift Near Silkeborg) By Fr. Weis, From the Danish Experimental Forestry Service, Koebenhavn, Vol. 13, No. 2, 1933. pp. 63-112. Translated from the Danish by H. Rann, June, 1934.

Tutkimuksia Karjan Vaijutuksesta Hakkausalojen Kasvillisuuteen (On the Influence of Pasturing on the Vegetation of Cutting Areas) By Martii Hertz, From Acta Forestalia Fennica 40, 1934, pp. 417, 441. Translated from the German by A. H. Krappe, August 3, 1934.

O Roli Lessa V Povyshenii Urojainosti (The Role of the Forest in Raising the Yield of Farmland) By Prof. G. N. Vyssotsky, From Lessnoye Khoziaistvo, Published by "Selkhozgiz" Moscow, 1929, No. 10-11. p. 19-44. Translated from the Russian by Dr. C. P. de Blumenthal. Nov. 5, 1934.

Die Ansschlaggehende Bedeutung Des Wasserhaushaltes Fur Die Ertragsleistungen Unserer Diluvialen Sande (The Outstanding Significance of Water Conservation in the Yield of our Diluvial Sands) By Prof. Dr. Albert From Zeitschrift Fur Forst- Und Jagdwesen. Vol. 56, April 1924, pp. 193-202 Translated from the German by R. G. True, October, 1934.

Metéorologie Influence D'Une Forêt Sur La Température De L'Air (Meteorology - Influence of a Forest on the Temperature of the Air) By Paul Seltzer, From Comptes Rendus Des Séances De L'Académie Des Sciences. Vol. 199, No. 6, pp. 435-438. Translated from the French by Mrs. I. M. Myer, Sept. 1934.

Quelques Constatations Concernant L'Emploi Des Pluviometres Totalisateurs Dans L'Étude De L'Influence De La Forêt Sur Le Régime Des Eaux (Some Observations Concerning the Use of "Rain Cans" In Studying the Influence of Forests Upon Water) By K. A. Meyer, From Journal Forestier Suisse, Vol. 82, pp. 200-205, 1931. Translated from the French by A. H. Krappe, August 1934. (No. 23)

Einfluss Der Provenienz Des Samens Auf Die Eigenschaften Der Forstlichen Holzgewächse (Effect of the Source of Seed Upon the Qualities of Forest Woody Plants) By Arnold Engler, From Mitteilungen der Schweizerischen Central Anstalt für das Forstliche Versuchswesen, Vol. 8, 1905, pp. 81-89. Translated from the German by Charles Kiener, Sept. 1934.

Ett 25-årigt Försök Med Naturföryngring I Norrländsk Råhumus Granskog (A Twenty-five year Experiment with Natural Reproduction in the Norrlandish Raw Humus Norway Spruce Forest) By Sven Petrini. Translated from the German by Charles Kiener, Sept. 1934, (No. 30).

Die Meteorologischen Faktoren Des Bodenauffrierens Und Die Rolle Der Frostlinien Bei Auffrierungschäden (The Meteorological Factors of Soil-Lifting by Frost and the Part that Frost Lines Play in Such Damage) By Erwin Ijjász, From Erdészeti Kisérletek, Vol. XXXV, 1933, Issue 3, pp. 318-319. Translated from the German by Albin Meier, July, 1934. (No. 21)

Qualitative und Quantitative Untersuchungen Über Die Macroskopische Pilzflora Der Waldböden (Qualitative and Quantitative Investigations of the Macroscopic Fungal Flora of Forest Soils in the Forest Region of Sopron) By D. Feher and Z. Besenyei, Of the Botanical Institute of the Royal Hungarian University for Mining and Forest Engineers. From Erdészeti Kisérletek, Vol. XXXV, 1933, Issue 3, pp. 274-8. Translated from the German by Albin Meier, July, 1934 (No. 20)

Internationaler Forstwirtschaftsbericht (International Forestry Report) From the Communications of the Institute for Foreign and Colonial Forestry at the Forestry University of Tharandt. In the Zeitschrift Für Weltforstwirtschaft Vol. I, No. 7, pp. 439-447, 1934. Translated from the German by Albin Meier, July, 1934. (No. 24).